

FINAL PROJECT INSTRUCTIONS

7 February 2001

NOAA SHIP RONALD H. BROWN

Cruise RB-01-02

ACE-Asia

14 March – 20 April 2001

Chief Scientist

Timothy S. Bates

NOAA/Pacific Marine Environmental Laboratory

Ocean Climate Research Division

7600 Sand Point Way, NE

Seattle, Washington 98115

ENDORSEMENTS:

/S/ *Eddie N. Bernard*

Dr. Eddie N. Bernard
Director, Pacific Marine Environmental Laboratory
Seattle, WA 98115

RADM Nicholas A. Prael, NOAA
Director, Marine Operations Center
Norfolk, VA 23510

NOAA RESEARCH CRUISE

ACE-Asia

Atmospheric Aerosols and Climate Change

Participating Organizations:

NOAA Pacific Marine Environ. Lab., Seattle, WA (PMEL)
University of Washington, Seattle, WA (UW)
Naval Postgraduate School, Monterey, CA (NPGS)
Joint Institute Study Atmosphere Ocean, Seattle, WA (JISAO)
Inst. for Tropospheric Research, Leipzig, Germany (IfT)
University of California, Riverside, CA (UCR)
University of Maryland, College Park, MD (UMD)
University of Miami, Miami, FL (UM)
Princeton University, Princeton, NJ (PU)
Georgia Institute of Technology, Atlanta, GA (GIT)
Scripps Institution of Oceanography, La Jolla, CA (SIO)
Rutgers University, New Brunswick, NJ (RU)
Arizona State University, Tempe, AZ (ASU)
University of Illinois, Urbana, IL (UI)
Academia Sinica & National Central University, Taiwan (AS)
University of California, Davis, CA (UCD)
Hokkaido University, Sapporo, Japan (HU)
Brookhaven National Laboratory, Long Island, NY (BNL)
NASA, Langley, VA (NASA-L)
Shirshov Institute of Oceanology, Moscow, Russia (SIOM)
Ocean University of Qingdao, China (UQ)
Finnish Institute Marine Research, Helsinki, Finland (FIMR)
Nagoya University, Nagoya, Japan (NU)
Takai University, Shizuoka, Japan (TU)
University of Wisconsin, Madison, WI (UWI)
ANSTO, Menai, NSW, Australia (ANSTO)

NOAA SHIP: Ronald H. Brown
Cruise No: RB-01-02
Area: NW Pacific Ocean
Yellow Sea, East China Sea
Itinerary:
d. Honolulu 14 Mar 2001
a. Yokosuka 20 Apr 2001

Cruise Description and Objectives:

ACE-Asia is the fourth in a series of experiments, organized under the International Global Atmospheric Chemistry (IGAC) Program, designed to quantify the spatial and vertical distribution of aerosol properties, the processes controlling their formation, evolution and fate, and the column integrated clear-sky radiative effect of the aerosol. The ACE-Asia intensive field study in March/April 2001 will involve coordinated measurements aboard *NOAA SHIP Ronald H. Brown*, three aircraft, satellites, and ground stations by investigators from many countries.

Measurements aboard *Ronald H. Brown* will be conducted continuously while the ship is in transit and on CTD-Optics stations. The ship will stop daily during the SeaWiFS overpass (approximately noon) and in cloud-free conditions during AVHRR (mid-afternoon) and/or Terra overpasses (mid-morning) to sample the upper water column. Measurements include:

- atmospheric measurements of aerosol physical, optical and hygroscopic properties, size resolved aerosol chemical composition including major anions and cations, mineral dust, and organic and elemental carbon, total condensation nuclei population, aerosol optical depth, dimethylsulfide, sulfur dioxide, carbon monoxide, carbon dioxide, hydrocarbons, radon, ozone, and lidar measurements of aerosol backscatter
- routine weather observations (air temperature, dew point temperature, wind speed and direction, barometric pressure and light levels at several spectra), and rawinsonde balloon launches for atmospheric temperature, dew point and winds,
- surface seawater measurements of dimethylsulfide, pCO₂, chlorophyll, salinity, and temperature,
- water leaving radiance, solar irradiance, diffuse sky radiance
- satellite observations of aerosol optical depth, aerosol number/size, ocean color.
- CTD/optical casts for up and downwelling radiance, PAR, fluorescence, transmissivity.
- CTD/rosette casts for chlorophyll, pigments, total absorption of suspended material.

Ship Operations Contact:
CDR Jon Rix (757-441-6842)
Jon.E.Rix@noaa.gov (fax 757-441-6495)
NOAA/MOA
439 West York Street
Norfolk, Virginia 23510

Scientific Operations Contact:
Timothy Bates (206-526-6248) bates@pmel.noaa.gov
LT Carrie Hadden (206-526-4485)
NOAA/PMEL (R/PM)
7600 Sand Point Way N.E., Bldg. 3
Seattle, WA 98115

1.0 SCIENTIFIC OBJECTIVES

Atmospheric aerosol particles affect the Earth's radiative balance directly by scattering or absorbing light, and indirectly by acting as cloud condensation nuclei (CCN), thereby influencing the albedo and life-time of clouds. At this time, tropospheric aerosols pose one of the largest uncertainties in model calculations of the climate forcing due to man-made changes in the composition of the atmosphere (IPCC, 1996). Accurately quantifying the direct and indirect effect of anthropogenic aerosols on the radiative forcing of climate requires an integrated research program (NRC, 1996) that includes:

- in-situ measurements covering a globally representative range of natural and anthropogenically perturbed environments to determine the chemical, physical, and radiative properties of the major aerosol types, the relationships among these properties and the processes controlling them,
- satellite observations to quantify the temporally and spatially varying aerosol distributions, and
- chemical transport and radiative transfer models to calculate radiative forcing by aerosols and to provide a prognostic analysis of future radiative forcing and climate response under various emission scenarios.

The International Global Atmospheric Chemistry Program (IGAC) has organized a series of Aerosol Characterization Experiments (ACE) that integrate in-situ measurements, satellite observations, and models to reduce the uncertainty in calculations of the climate forcing due to aerosol particles. ACE-Asia is the fourth in this series of experiments and consists of three focused components in the 2000-2004 timeframe:

1. In-situ and column integrated measurements at a **network of ground stations** will quantify the chemical, physical and radiative **properties of aerosols** in the ACE-Asia study area and assess their spatial and temporal (seasonal and inter-annual) variability (2000-2004).
2. An **intensive field study** (the purpose of this NOAA Research Cruise) will be used to quantify the spatial and vertical distribution of **aerosol properties, the processes** controlling their formation, evolution and fate, and the **column integrated clear-sky radiative effect** of the aerosol (March through April, 2001).
3. Focused intensive experiments will quantify **the effect of clouds on aerosol properties and the effect of aerosols on cloud properties (indirect aerosol effect)** (Spring 2001 and Spring 2003).

The intensive field study in March/April 2001 will involve NOAA SHIP Ronald H. Brown, three aircraft, satellites, and surface observations by investigators from many countries. The project has three overall scientific objectives:

- Objective 1. Determine the physical, chemical, and radiative properties of the major aerosol types in the Eastern Asia and Northwest Pacific region and investigate the relationships among these properties.
- Objective 2. Quantify the interactions between aerosols and radiation in the Eastern Asia and Northwest Pacific region.
- Objective 3. Quantify the physical and chemical processes controlling the evolution of the major aerosol types and in particular of their physical, chemical, and radiative properties.

Further information about ACE-Asia can be found on the Project Website (saga.pmel.noaa.gov/aceasia/).

2.0 PERSONNEL

2.1 Chief Scientist

Dr. Timothy Bates (PMEL)

The Chief Scientist is authorized to alter the scientific portion of this cruise plan with the concurrence of the Commanding Officer, provided that the proposed changes will not: (1) jeopardize the safety of the personnel or the ship; (2) exceed the allotted time for the cruise; (3) result in undue additional expense; or (4) change the general intent of the cruise.

2.2 Participating Scientists

	Name	Gender	Nationality	Affiliation
1.	Dr. Timothy Bates	M	USA	PMEL
2.	Dr. James Johnson	M	USA	JISAO/PMEL
3.	Mr. Derek Coffman	M	USA	JISAO/PMEL
4.	Dr. Theresa Miller	F	USA	JISAO/PMEL
5.	Mr. Drew Hamilton	M	USA	JISAO/PMEL
6.	Dr. Dave Covert	M	USA	UW
7.	Mr. Andreas Massling	M	Germany	IFT
8.	Mr. Andreas Nowak	M	Germany	IFT
9.	Mr. Stephan Leinert	M	Germany	IFT
10.	Dr. Christian Carrico	M	USA	GIT, UI
11.	Dr. Sergio Guazzotti	M	Argentina	UCR
12.	Mr. David Sodeman	M	USA	UCR
13.	Ms. Monica Rivera	F	USA	PU
14.	Mr. Ho-Jin Lim	M	S. Korea	RU
15.	Mr. Yoshihisa Mino	M.	Japan	NU
16.	Dr. Robert Frouin	M	USA	SIO
17.	Mr. David Bates	M	USA	UMD/UM
18.	Mr. Kevin Maillet	M	USA	UM
19.	Dr. Piotr Flatau	M	Poland	SIO
20.	Mr. Krzysztof Markowicz	M	Poland	SIO
21.	Dr. Wenying Su	F	China	NASA-Langley
22.	Dr. Greg Mitchell	M	USA	SIO
23.	Mr. Scott Storms	M	USA	SIO
24.	Dr. Oleg Kopelevitch	M	Russia	SIOM
25.	Dr. Haili Wang	M	China	UQ
26.	Dr. Mika Raateoja	M	Finland	FIMR
27.	Mr. Tomohiro Horiuchi	M	Japan	TU
28.	Dr. Michihiro Mochida	M	Japan	HU
29.	Mr. Tai-Hua Chou	M	Taiwan	NCU, AS
30.	Ms. Susan Carty	F	USA	NOAA

3.0 SCHEDULE

The ACE-Asia *Ronald H. Brown* Research Cruise will depart Honolulu, Hawaii on March 14, 2001 and arrive in Yokosuka, Japan on April 20, 2001. A tentative cruise track and waypoint list are shown in Appendices A and B. The transect across the Pacific may be adjusted depending on the meteorological flow patterns from Asia and the cloud cover. Operations after the first week of the cruise will be coordinated daily with the ACE-Asia aircraft and ground stations. During the cruise, the ship will hold station (12-24 hours) alongside ground stations at Hachijo Island (Hatizyo Sima), Amami-O Sima, and Kosan, Cheju Island (JeJu Do) for measurement intercomparisons.

Each science group aboard *Ronald H. Brown* will send an email status report of their measurements to the Chief Scientist by 0600 LT each morning. The Chief Scientist will prepare a report for the ACE-Asia Operations Center by 0700 each morning. This report will need to be sent from the ship in the email transmission at 0700 LT (0800 LT when the C-130 is not flying) to be available for the daily planning meeting at the operations center in Iwakuni, Japan. The scientific party aboard *Ronald H. Brown* will meet at 0800 daily to discuss the plan of the day. An update from the operations center will be sent to the ship via email at approximately 1700 JST and will be posted on the ship's ACE-Asia web page.

4.0 OPERATIONS

4.1 Underway Measurements

The following continuous measurements will be made aboard RONALD H. BROWN during transit and while on station:

- 1) In-situ aerosol measurements:
 - a) Chemical:
 - i) Size resolved chemical sampling for inorganic ions, mineral dust, and total and organic carbon. (2 and 7 stage Berner-type impactors at 55% RH, Quinn, PMEL)
 - ii) Single particle analysis by mass spectrometry (Prather, UC Riverside)
 - iii) Sub-micron (55% RH) organic carbon functional groups using FTIR (Turpin, Rutgers & Russell, Princeton)
 - iv) Single particle organic carbon functional groups using PIXE streaker with X-ray analysis (Russell, Princeton)
 - v) Fast (1hr) submicron (55% RH) OC/EC (Turpin, Rutgers)
 - vi) Size resolved chemical sampling for hydrogen (organic surrogate for mass closure) and speciated organics with LDI TOF/MS (3 stage drum sampler at 55% RH, Cahill & Perry, UC Davis)
 - vii) Size distributions of mass (beta gauge), optical absorption - 9 wavelengths, elements Na to Zr: heavy metals (8 stage drum sampler at 55% RH, Cahill & Perry, UC Davis)
 - viii) Single particle analysis with SEM and TEM (Anderson, Arizona State)
 - ix) Organic speciation with GCMS (Schauer, Univ. Wisconsin)

- x) Lipid class compounds (dicarboxylic acids, hydrocarbons, fatty acids, alcohols, etc.) with GC and GCMS (Kawamura, Hokkaido University)
- b) Physical and optical:
 - i) Number size distribution from 5 to 10,000 nm diameter using twin DMPS and APS system at 55% RH (Covert, UW & Bates, PMEL).
 - ii) Number size distribution from 5 to 10,000 nm diameter using twin DMPS and APS system at <10% RH (Wiedensohler, IfT).
 - iii) Number size distribution from 20 to 10,000 nm diameter using DMPS and APS system at 10, 30, 55, 75, and 90% RH (Wiedensohler, IfT).
 - iv) Size resolved mass (gravimetric) size distribution (2 and 7 stage Berner-type impactors at 55% RH, Quinn, PMEL).
 - v) Total particle number (TSI 3010, 3025) (Covert, UW & Bates, PMEL)
 - vi) Total and sub-micron (55% RH) light scattering and backscattering by aerosols at 3 wavelengths (Quinn, PMEL)
 - vii) Total and sub-micron (55% RH) light absorption by aerosols at 550 nm (Quinn, PMEL)
 - viii) Aerosol hygroscopic growth of particles with diameters between 50-250 nm (H-TDMA) (Covert, UW)
 - ix) Aerosol hygroscopic growth of particles with diameters between 700-1200 nm (H-DMA/APS) (Wiedensohler, IfT)
 - x) Total and sub-micron (55% RH) light scattering and backscattering by aerosols at 3 wavelengths while scanning RH for increasing and decreasing conditions (fRH) (Rood, Univ. Ill.)
- 2) Column measurements:
 - a) Aerosol optical thickness using Microtops sunphotometers (Quinn, PMEL)
 - b) LIDAR measurements of aerosol vertical distribution (Welton, U. MD)
 - c) Water leaving radiance and aerosol optical thickness in 11 spectral bands (SIMBAD, Frouin, SIO)
 - d) Water leaving radiance in 18 spectral bands (SP1A spectral photometer, Su, NASA-Langley)
 - e) Aerosol optical thickness, single scattering albedo in the visible and near-infrared and aerosol size distribution with a PREDE sunphotometer-skyradiometer (Frouin, SIO)
 - f) Aerosol optical thickness with Microtops sunphotometers (Frouin, SIO)
 - g) Direct-beam normal irradiance, diffuse irradiance, total irradiance, aerosol optical thickness (fast-rotating shadowband radiometer, Miller & Reynolds, BNL)
 - h) Sky images and cloud fraction (total sky imager, Miller & Reynolds, BNL)
 - i) Kipp & Zonen Pyranometer (Global on Gymbals): Two; one broad band and one filtered for visible. BSI-Photo-Diode radiometer (with 5 channels) : One global on Gymbal. An ASD spectral radiometer (global) (Flatau, SIO)
 - j) Satellite observations of aerosol optical depth and aerosol number/size using shipboard retrieval of AVHRR and SeaWiFS imagery (Johnson, PMEL & Durkee, NPGS)
- 3) Trace gases
 - a) Ozone, CO (Johnson, PMEL)
 - b) Radon (Johnson, PMEL & Zahorowski, ANSTO)
 - c) DMS, SO₂ (Bates, PMEL)

- d) NMHC (Tai Chen, Academia Sinica)
- e) CO₂ (Feely, PMEL & Wanninkhof, AOML)
- 4) Seawater measurements
 - a) DMS (Bates, PMEL)
 - b) SST, salinity (PMEL)
 - c) pCO₂, chlorophyll, oxygen (Feely, PMEL & Wanninkhof, AOML)
- 5) Meteorological measurements
 - a) Surface meteorological data (Johnson, PMEL)

Air samples will be collected using equipment mounted on the forward part of the 02 level. A mast will extend approximately 8 meters above the deck for air sampling lines. Additional air sampling lines will run from this location to the oceanographic laboratories and laboratory van (Al Van) on 01 level port side.

Radiometers will be mounted on the AOML bow tower.

Ship and scientific personnel must constantly be aware of potential sample contamination. Work activities forward of the main stack must be secured during sampling operations. This includes the bow, boat deck forward of the stack, bridge deck and flying bridge. The scientists on watch must be notified of any change in ship course or speed that will move the relative wind abaft the ship's beam or if anyone needs access to the bow. The scientists on watch should also be notified when the ship enters a rain squall and when the rain subsides.

Continuous water sampling will be made from the ship's bow intake system. This system must be capable of delivering 75 liters per minute through the main deck piping. Seawater will be drawn off this line to the Al Van on 01 level port side and the sea/air CO₂ equilibrator in the hydro lab. Care must be taken to prevent contamination from smoke, solvent, cleaning solutions, etc.

4.2 Station Measurements

- b) Ocean spectral (uv-visible) reflectance, spectral backscattering coefficients, spectral beam attenuation coefficients, ocean particle size distribution (Mitchell, SIO)
- c) Microscopic phytoplankton counts, phytoplankton pigments (fluorometric chlorophyll, HPLC pigments), and particle and soluble spectral absorption coefficients, from CTD samples (Mitchell, SIO)
- d) Microscopic zooplankton speciation from net tows (Mitchell, SIO)

4.3 Station Operations

A CTD/optics (SIO CTD deployed from stern A-frame) cast and a CTD/rosette (ship's system deployed from starboard side) cast will be made each day at the time of the SeaWiFS satellite overpass. The ship may need to reposition to ensure that the ship's HRPT antennae can view SeaWiFS during direct broadcast near noon. On clear days an in-water radiance distribution camera system (PRR-800) will be deployed from the stern. This package is placed in the water

and floated away, while tethered, from the ship. We propose to deploy the PRR-800 and CTD-rosette simultaneously as was done during Aerosols99 and INDOEX. The MER optical package will be deployed after the PRR-800 and CTD-rosette have returned to the deck. Atmospheric and surface seawater sampling will continue while on station. The ship will remain headed into the wind to prevent contamination from the ship's exhaust and vents. Again, extreme care must be exercised to prevent contamination of the air samples. The scientists on watch must be notified of any ship operation that will move the relative wind abaft the ship's beam.

CTD operations will be conducted by the survey department and scientists from SIO. Maximum cast depth for the CTD/rosette cast will be 300m with most samples collected in the photic zone (6-8 depths). Water from the rosette cast will be sampled for chlorophyll, HPLC pigments, and absorption by total suspended matter. Some of the water collected will be preserved to count the total number of phytoplankton.

An additional station will occur on cloud free days during the Terra (mid-morning) or AVHRR (mid-afternoon) overpass.

Time permitting, plankton tows will be conducted at the conclusion of the CTD casts. The plankton tows using a 1 m diameter net with a mesh size of approximately 0.333 mm will be depth-integrated, oblique tows down to 300m in the deep ocean. For shallow shelf stations, deployment to ~20m above the bottom is desired. The ship speed should be slowed to approximately 1.5 knots before deployment of the net. The net will be deployed off the starboard side A-frame, using a 0.322 CTD conducting cable winch, and a hydro-weight of 100-120 lbs. The conducting leads of the cable will not be used. The net will be secured to the end of the ship's 0.322 cable using a brass wire clamp (thumb screws to secure) and the weight will be secured using a standard galvanized steel wire grip. The weight and 0.322 block will be supplied by the ship. Both the CTD and the net will be deployed via starboard A-frame but through separate blocks, and using separate winches.

The hydro-weight should be deployed over the side while the person conducting the tow is holding onto the ring net. The net can be dropped into the water once the weight is below the surface and appears unlikely to tangle in the net. The net will be deployed out at 40m/minute to a maximum wire out of 425m. The wire angle should remain at approximately 45 degrees throughout the tow to ensure that the net reaches the appropriate depth; ship speed may need to be modified to maintain this wire angle. The person conducting the tow should monitor the distance between the hull and the winch wire, and alert the OOD if it appears to be close enough to risk tangling in the propeller. After waiting for 1 minute at depth the net will be retrieved at 20m/minute, until it reaches the surface. The net will be rinsed down with seawater, and brought aboard for preservation of the sample. The entire procedure will require 35-45 minutes. Samples will be placed in pre-labeled sample jars with ethanol. All aspects of this sampling will be coordinated by Greg Mitchell's group. A member of the ship's crew will be required for winch operations during the deployments.

4.4 Balloon Launches

Atmospheric temperature, humidity and wind profiles will be obtained from rawinsondes released up to four times per day at 0500, 1100, 1700 and 2300 UCT. The data from these launches will be sent by the ship to the National Weather Service.

5.0 FACILITIES

5.1 Equipment and capabilities to be provided by ship

The following systems and their associated support services are essential to the cruise. Sufficient consumables, back-up units, and on-site spare parts and technical support must be in place to assure that operational interruptions are minimal. All measurement instruments are expected to have current calibrations and all pertinent calibration information shall be included in the data package.

- 1) Navigational systems including high resolution GPS.
- 2) CTD/rosette sampling system. The CTD system will be operated by ship's personnel. Specific requirements for this system are:
 - (1) 2 CTD capable winch systems with 500 meter depth capability,
 - (2) 1 Seabird 911 plus CTD unit with temperature and salinity sensors to be used as the backup CTD system for ACE-Asia
 - (3) CTD stand and rosette,
 - (4) Backup temperature and salinity sensor for PMEL Seabird plus CTD unit.
- 3) Autosal Salinometer and salinity sample bottles.
- 4) Thermosalinograph calibrated to within 0.1°C and 0.01 ppt.
- 5) Dry compressed air (120 psi, 4 CFM) to the pump van and new Aero van. Power, water and telephone connections to vans (see section 5.2).
- 6) Continuously flowing seawater to the vans and equilibrators (minimum of 75 liters per minute).
- 7) Laboratory/work space.
- 8) Freezer space for air and seawater samples.
- 9) Refrigerator space (10 cubic feet) for air samples (no chemicals).
- 10) Satellite receiving station.
- 11) Radiosonde deployment system.

12) Hood for use of solvents (dichloromethane).

5.2 Equipment, capabilities and supplies provided by scientific party

1) Vans (van locations are shown in appendix D)

a) Chemistry van (AL van)

wt 10,000 lbs
 size 8' X 20'
 power 30 amps 480 v three phase
 location port side 01 level
 Needs freshwater and clean seawater lines and phone.
 Load in Hawaii Offload in Japan

b) Old Aerosol van

wt 12,000 lbs
 size 8' X 18'
 power 50 amp 480 v three phase
 location port side 02 level
 Needs a phone.
 Load in Charleston, Offload in Victoria

c) New Aerosol van

wt 12,000 lbs
 size 8' X 20'
 power 50 amp 480 v three phase
 location port side 02 level
 Needs phone, compressed air.
 Load in Hawaii, Offload in Japan

d) Pump/Lidar van

wt 5,000 lbs
 size 7' X 12'
 power from aerosol van
 location aft of old aerosol van, 02 level
 Needs compressed air (120 psi/4 CFM).
 Load in Hawaii, Offload in Victoria

e) Spare parts/storage van,

wt 12,000 lbs
 size 8' X 20'
 power none
 location port side, 01 level
 Load in Hawaii, Offload in Victoria

f) IfT van

wt 15,000 lbs
 size 20' x 8'
 power 50 amp 480 v three phase
 location starboard side, 02 level
 Needs phone, compressed air (120psi/2 CFM).

Load in Hawaii, Offload in Japan

g) SIO isotope/filtration Van

wt 4,000 lbs
 size 7.5' x 13.5'
 power 480 v, 30 amp, single phase
 location Main deck port side of staging bay
 needs phone and fresh water

Loaded in San Diego, Offload in Victoria

- 2) One Seabird 911 plus CTD unit to be used as the primary system. The system will include: stand, fish, cables, altimeter, rosette, deck unit, termination kit, and re-termination kit. If the backup system is needed, the ship's ET will need to perform the termination for the CTD.
- 3) Twelve 10-L "Bullister" bottles.
- 4) Air sampling equipment including pumps, flowmeters, filters, gas and aerosol analyzers, aerosol sizing instrumentations, condensation nuclei counters, radiometers and lidar.
- 5) Chemical analysis instrumentation including gas chromatographs, ion chromatographs, and mass spectrometers.
- 6) Chemical reagents, compressed, and liquid nitrogen. A complete listing of all chemicals to be brought onboard is included in Appendix C. Material Data Safety Sheets will be provided to ship before any chemicals are loaded.
- 7) CTD/Optics winch (480 V, 20 amps, 4'x4' footprint, 3500 lbs) Wire on drum: Approx. 500-700 meters of .322 3-conducting, armored sea cable. SIO will provide a .322 block to hand from the A-frame for deployment.
- 8) MER 2048/2041 optical package with integrated AC9, FRRF, Hydroscat, fluorometer, transmissometer. This package will be deployed off the A-frame using the SIO winch. The package will be stored in the staging bay between casts.
- 9) PRR-800 free fall radiometer will require a small space on the aft starboard corner for deployment and cable storage. Approx. 4' x 4'.

- 10) SIO wet-lab equipment (two waist high (approx. 4'x8') tables are needed in this area, one on the forward wall next to the hood, and one on the port wall across from the sink area. Some of the instruments listed below will be secured to these tables).
- i) PRR-800, MER 2048, Hydrosat and FRRF deckboxes, and associated computers
 - ii) Cary spectrophotometer, integrating sphere and computer
 - iii) Coulter Counter, Multisizer, and computer
 - iv) Millipore Alpha-Q system for clean water
 - v) 35 liter liquid nitrogen dewar
 - vi) Spex Fluoromax spectrofluorometer and computer
- 11) Chest freezer for storing organic samples.
- 12) Rawindesondes, balloons and helium
- 13) PREDE radiometer to be mounted on 03 level forward.
 table mount about 2 x 3 x 1 m (1 m high)
 power 110v, 200 watts
- 14) Gimbal mounted whole sky camera (RADS) system to be mounted on 03 level forward.
 Dimensions about 2 feet square.
 Power 110V, 10 amps.
 Data cable: 50 foot which needs to run to a computer.
- 15) Other consumable- i.e. pens, pencils, paper, data storage media, etc.

6.0 DISPOSITION OF DATA AND REPORTS

6.1 Data responsibilities

The Chief Scientist is responsible for the disposition, feedback on data quality, and archiving of data and specimens collected on board the ship for the primary project. The Chief Scientist is also responsible for the dissemination of copies of these data to participants on the cruise and to any other requesters. The ship will assist in copying data and reports insofar as facilities allow. The ship will provide the Chief Scientist copies of the following data:

- Sightings log (position, speed, course, distance upwind) of other vessels
- Autosal salinity analysis logs
- Navigational log sheets (MOAs)
- Weather observation sheets
- Autosal calibration reports
- Thermosalinograph calibration reports
- CTD cast logs
- CTD calibration reports
- CTD data in ASCII format
- Weather maps
- SCS data tapes

The Chief Scientist will receive all original data gathered by the ship for the primary and piggy-back projects, and this data transfer will be documented on NOAA form 61-29 "Letter Transmitting Data". The Chief Scientist in turn will furnish the ship a complete inventory listing of all data gathered by the scientific party, detailing types and quantities of data.

The Commanding Officer is responsible for all data collected for ancillary projects until those data have been transferred to the projects' principal investigators or their designees. Data transfers will be documented on NOAA Form 61-29. Copies of ancillary project data will be provided to the Chief Scientist when requested. Reporting and sending copies of ancillary data to NESDIS (ROSCOP) is the responsibility of the program office sponsoring those projects.

6.2 Ship operation evaluation report

A Ship Operations Evaluation Report will be completed by the Chief Scientist and given to the Director, PMEL, for review and then forwarded to OMAO.

6.3 Foreign research clearance reports

A request for research clearance in foreign waters (Japan, China, S. Korea) has been submitted by PMEL. Copies of clearances received will be provided to the Operations Officer before departure. The Chief Scientist is responsible for satisfying the post-cruise obligations associated with diplomatic clearances to conduct research operations in foreign waters. These obligations consist of (1) submitting a "Preliminary Cruise Report" immediately following the completion of the cruise involving the research in foreign waters (due at OMAO within 30 days); and (2) ultimately meeting the commitments to submit data copies of the primary project to the host foreign countries.

7.0 ADDITIONAL INVESTIGATIONS AND PROJECTS

Any ancillary work done during this project will be accomplished with the concurrence of the Chief Scientist and on a not-to-interfere basis with the programs described in these instructions and in accordance with the NOAA Fleet Standing Ancillary Instructions.

Personnel assigned to ancillary projects and participating in the cruise, may be assigned additional scientific duties in support of the project by the Chief Scientist.

Synoptic weather reports will be handled in accordance with NC Instruction 3142D, SEAS Data Collection and Transmission Procedures.

Any additional work will be subordinate to the primary project and will be accomplished only with the concurrence of the Chief Scientist and Commanding Officer on a not-to-interfere basis.

8.0 COMMUNICATIONS

Per 1999 policy changes, the following applies:

The Chief Scientist or designated representative will have access to ship's telecommunications systems on a cost-reimbursable basis. Where possible, it is requested that direct payment (e.g. by credit card) be used as opposed to after-the-fact reimbursement. Ship's systems include:

- INMARSAT-A, for high-speed data transmission, including FTP, and high quality voice telephone communications. Costs range from \$7-\$15 per minute for use of the service, and may be charged to credit card or otherwise reimbursed. Phone numbers for ship's INMARSAT-A are: xxx-154-2643 voice and xxx-154-2644 fax. (Where xxx stands for the ocean satellite covering the region the ship is operating in.)
- INMARSAT-M, for voice telephone communications and 2400 baud data transfer, about \$3 per minute to the US. Phone number for ship's INMARSAT-M system is xxx-761-831-360. INMARSAT-M may be charged to credit card, collect, or otherwise reimbursed.
- E-MAIL: An email account for each embarked personnel will be established by the shipboard electronics staff. Due to the escalating volume of e-mail and its associated transmission costs, each member of the ship's complement, crew and scientist, will be authorized to send/receive up to 15 KB of data per day (\$1.50/day or \$45/month) at no cost. E-mail costs accrued in excess of this amount must be reimbursed by the individual. At or near the end of the cruise, the Commanding Officer will provide the Chief Scientist with a detailed billing statement for all personnel in his party. Prior to their departure, the Chief Scientist will be responsible for obtaining reimbursement from any member of the party whose e-mail costs have exceed the complimentary entitlement.

9.0 HAZARDOUS MATERIAL

RONALD H BROWN will operate in full compliance with all environmental compliance requirements imposed by NOAA. **All hazardous materials/substances needed to carry out the objectives of the embarked science mission, including ancillary tasks, are the direct responsibility of the embarked designated Chief Scientist, whether or not that Chief Scientist is using them directly.** The RONALD H BROWN Environmental Compliance Officer will work with the Chief Scientist to ensure that this management policy is properly executed, and that any problems are brought promptly to the attention of the Commanding Officer.

All hazardous materials require a Material Safety Data Sheet (MSDS). Copies of all MSDSs shall be forwarded to the ship at least two weeks prior to sailing. The Chief Scientist shall have copies of each MSDS available when the hazardous materials are loaded aboard. **Hazardous material for which the MSDS is not provided will not be loaded aboard.**

The Chief Scientist will complete a local inventory form, provided by the Commanding Officer, indicating the amount of each material brought onboard, and for which the Chief Scientist is responsible. This inventory shall be updated at departure, accounting for the amount of material being removed, as well as the amount consumed in science operations and the amount being removed in the form of waste. A list of chemicals and gases that will be brought onboard the ship for this cruise is listed in Appendix C.

The ship's dedicated HAZMAT Locker contains two 45-gallon capacity flammable material cabinets and one 22-gallon capacity flammable material cabinet, plus some available storage on the deck. Unless there are dedicated storage lockers (meeting OSHA/NFPA standards) in each van, all HAZMAT, except small amounts for ready use, must be stored in the HAZMAT Locker.

The scientific party, under the supervision of the Chief Scientist, shall be prepared to respond fully to emergencies involving spills of any mission HAZMAT. This includes providing properly-trained personnel for response, as well as the necessary neutralizing chemicals and clean-up materials. Ship's personnel are not first responders and will act in a support role only, in the event of a spill. Drew Hamilton, Derek Coffman, and Theresa Miller have been trained in hazardous material response.

The Chief Scientist is directly responsible for the proper handling, both administrative and physical, of all scientific party hazardous wastes. **No liquid wastes shall be introduced into the ship's drainage system. No solid waste material shall be placed in the ship's garbage.**

10.0 RADIOACTIVE ISOTOPE POLICY

1. BROWN has no specially designated lab space for working with isotopes. We will therefore require that all radioisotope work be done in a dedicated van with its own storage area and separate waste discharge. The policy is consistent with that of the UNOLS fleet. All of the waste should remain segregated from the ship's waste and be packed out by the investigator;
2. Each scientist working with these materials will be required to wear a lab coat and disposable booties to reduce the likelihood of tracking the substance out of the van into the ship;
3. It will be the responsibility of the investigator to conduct pre-cruise (for background) and post-cruise wipe tests (regardless of whether a spill occurred or not). Wipe tests should also be conducted in the event of a spill, as well as periodically while underway.
4. A detailed procedural methodology describing the use of these materials should be provided to the ship for review at least one month prior to bringing them aboard. A spill contingency plan should also be provided at that time. Please note that ship's personnel will not be a cleanup resource in the event of a spill;
5. A log detailing the type and amount of materials brought aboard and taken off the ship should be maintained, along with a record of any spills that occurred;

6. All radioisotope work will be conducted by NRC or State licensed investigators only, and copies of these licenses shall be provided to the ship at least one month prior to bringing any materials onboard.

11.0 MISCELLANEOUS

11.1 Radio interference

Radio transmission can interfere with several of the continuous data streams. If this becomes a problem, the Commanding Officer and Chief Scientist will work out a transmission schedule to minimize data interferences to the extent that vessel communication needs allow.

11.2 Pre & post-cruise meetings

A pre-cruise meeting between the Commanding Officer and the Chief Scientist will be conducted either the day before or the day of departure, with the express purpose of identifying day-to-day project requirements, in order to best use shipboard resources and identify overtime needs.

A post-cruise debriefing will be held between the Chief Scientist and the Commanding Officer.

11.3 Scientific berthing

The Chief Scientist is responsible for assigning berthing for the scientific party within the spaces approved as dedicated scientific berthing. The ship will send stateroom diagrams to the Chief Scientist showing authorized berthing spaces. The Chief Scientist is responsible for returning the scientific berthing spaces back over to the ship in the condition in which they were received; for stripping bedding and for linen return; and for the return of any room keys which were issued.

The Chief Scientist is also responsible for the cleanliness of the laboratory and storage areas used by the science party, both during the cruise and at its conclusion prior to departing the ship.

In accordance with NC Instruction 5255.0, Controlled Substances Aboard NOAA Vessels, dated 06 August 1985, all persons boarding NOAA vessels give implied consent to conform with all safety and security policies and regulations which are administered by the Commanding Officer. All spaces and equipment on the vessel are subject to inspection or search at any time.

11.4 Emergency contacts

Prior to departure, the Chief Scientist must provide a listing of emergency contacts to the Executive Officer for all members of the scientific party, with the following information: name, address, relationship to member, and telephone number. These can be combined with the NOAA Health Services Questionnaire on the forms provided.

11.5 Shipboard Safety

A discussion of shipboard safety policies is in the “Science User’s Guide” which is available on RONALD H. BROWN and is the responsibility of the scientific party to read. This information is also available on the ship’s web page: www.moc.noaa.gov/rb/science/welcome.htm. A meeting with the Operations Officer will be held for the scientific party at the beginning of the cruise which will include a safety briefing. Wearing open-toed footwear (such as sandals) outside of private berthing areas is unsafe and is not permitted. All members of the scientific party are expected to be aware of shipboard safety regulations and to comply with them.

All personnel (including scientists) involved in suspended load operations on deck will be required to wear steel-toed safety shoes. Elsewhere in the ship, normal close-toed shoes are adequate.

11.6 Wage marine dayworker working hours and rest periods

Chief Scientists shall be cognizant of the reduced capability of RONALD H BROWN’s operating crew to support 24-hour mission activities with a high tempo of deck operations at all hours. Wage marine employees are subject to negotiated work rules contained in the applicable collective bargaining agreement. Dayworkers’ hours of duty are a continuous eight-hour period, beginning no earlier than 0600 and ending no later than 1800. It is not permissible to separate such an employee’s workday into several short work periods with interspersed nonwork periods. Dayworkers called out to work between the hours of 0000 and 0600 are entitled to a rest period of one hour for each such hour worked. Such rest periods begin at 0800 and will result in no dayworkers being available to support science operations until the rest period has been observed. All wage marine employees are supervised and assigned work only by the Commanding Officer or designee. The Chief Scientist and the Commanding Officer shall consult regularly to ensure that the shipboard resources available to support the embarked mission are utilized safely, efficiently and with due economy.

11.7 Medical Forms & Emergency Contacts

The NOAA Health Services Questionnaire must be completed in advance by each participating scientist. It should reach the ship no later than 4 weeks prior to the cruise. This will allow time to medically clear the individual and to request more information if needed. We ask that all personnel bring any prescription medication they may need and any over-the-counter medicine that is taken routinely (e.g. an aspirin per day, etc.). The ship maintains a stock of medications aboard, but supplies are limited and chances to restock are few.

11.8 Port Agent Services/Billing

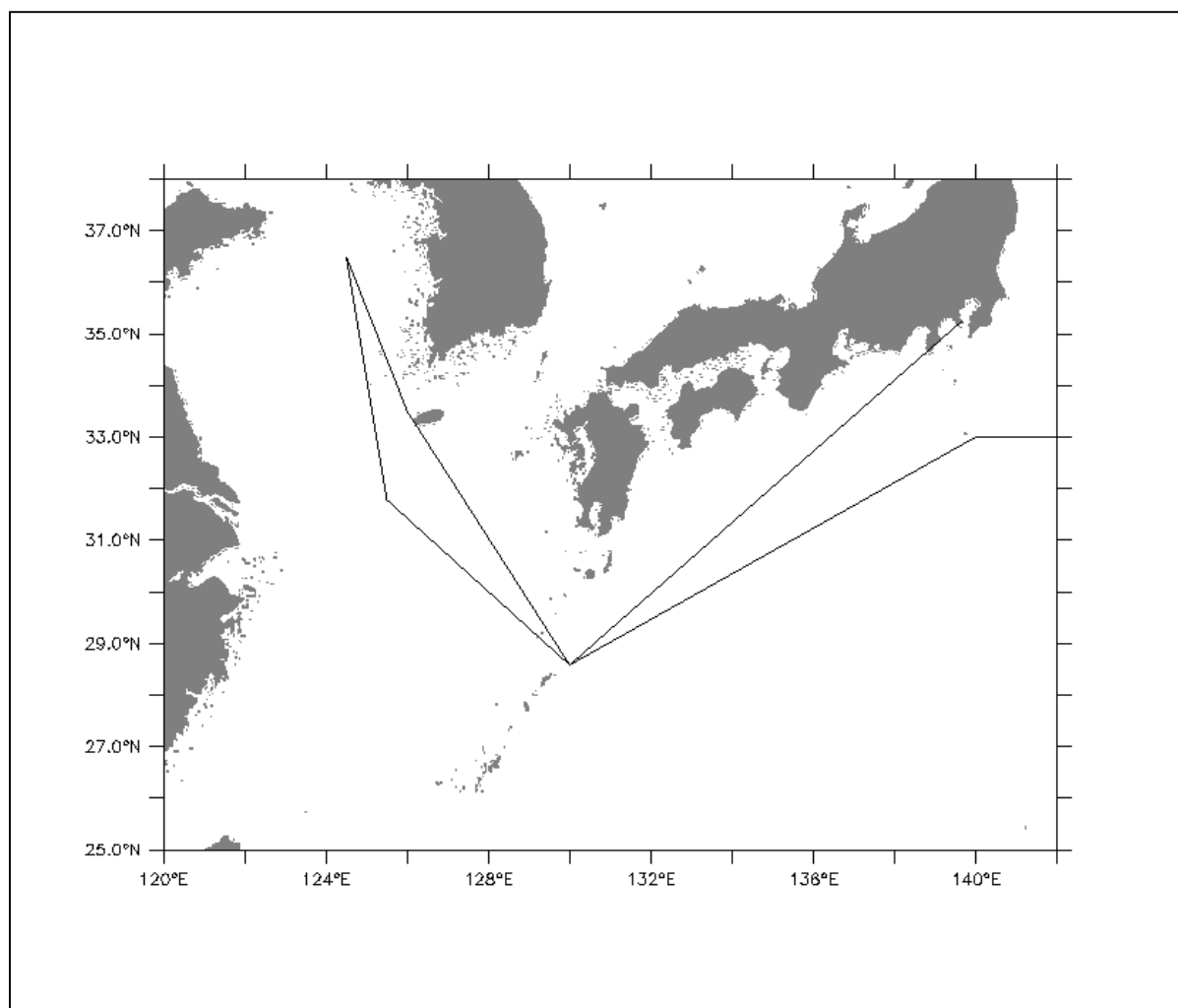
Contractual agreements exist between the port agents and the Commanding Officer for services provided to NOAA SHIP RONALD H. BROWN. The costs or required reimbursements for any services arranged through the ship’s agents by the scientific program, which are considered to be outside the scope of the agent/ship support agreement, will be the responsibility of that program.

Where possible, it is requested that direct payment be arranged between the science party and port agent, as opposed to after-the-fact reimbursement to the ship's accounts.

12.0 APPENDICES

- (A) Cruise track
- (B) Waypoints
- (C) List of chemicals onboard
- (D) C14 isotope procedures
- (E) Van locations

Appendix A. Cruise Track



Appendix B. Waypoints

12/07 ACE-Asia CRUISE PLAN

POINT	LAT DEG	LON DEG	DIST NM	SPD KTS	HRS UW	Arrive local DAY HR	Arrive UTC DAY HR	HRS Stops	HRS Sta	Depart local DAY HR
Honolulu	21.30	-157.90						12		03/14 10:00
WP1	33.00	-165.00	797	11.0	72	03/17 22:28	03/18 08:28	24	0	03/17 22:28
WP2	33.00	160.00	1753	11.0	159	03/25 09:49	03/25 23:49	18	0	03/25 09:49
Hatizyo Simo	33.00	140.00	1005	11.0	91	03/30 22:10	03/30 13:10	12	12	03/31 10:10
Amami-O Simo	28.50	130.00	582	11.0	53	04/03 03:03	04/02 18:03	12	12	04/03 15:03
Coastal China	30.50	123.00	385	5.0	77	04/07 07:58	04/06 22:58	9	0	04/07 07:58
Yellow Sea	37.00	123.00	390	5.0	78	04/10 22:58	04/10 13:58	12	0	04/10 22:58
Cheju Do	33.00	126.30	290	5.0	58	04/13 20:54	04/13 11:54	9	60	04/16 08:54
WP4	29.00	131.00	341	11.0	31	04/18 00:51	04/17 15:51	9	0	04/18 00:51
Yokosuka	35.25	139.66	578	11.0	53	04/20 14:22	04/20 05:22	0	168	04/27 14:00
MILES			6119							
DAYS			38.18							

Appendix C. List of chemicals

	Quantity	Group
<u>Compressed Gases</u>		
Currently on ship, to be off-loaded in Victoria		
He (sondes)	40 tanks	PMEL
CO2 (Neph)	2 tanks	PMEL
Helium (IC)	6 tanks	PMEL
Breathing air (DMS)	1 tanks	PMEL
H2 (OC/EC)	2 tanks	PMEL
O2 10% balance He (OC/EC)	2 tanks	PMEL
CH4 10% balance He (OC/EC)	2 tanks	PMEL
He (OC/EC)	2 tanks	PMEL
Breathing air (OC/EC)	2 tanks	PMEL
He (CO)	2 tanks	PMEL
H2 (OC/EC)	2 tanks	RU
O2 10% balance He (OC/EC)	2 tanks	RU
CH4 10% balance He (OC/EC)	2 tanks	RU
He (OC/EC)	3 tanks	RU
Breathing air (OC/EC)	8 tanks	RU
N2	2 tanks	AS
H2	2 tanks	AS
He	2 tanks	AS
N2	3 tanks	UCR
Zero Air	3 tanks	UCR
N2	5 tanks	uw pCO2
Standard air tanks	10 tanks	uw pCO2
To be loaded in Hawaii, off loaded in Japan		
NO 0.5% gas in N2	1 tank	HU
Ar	1 tank	HU
Liquid nitrogen	160 L	SIO
<u>Chemicals</u>		
acetone	16 L	SIO
acetone	4 L	uw pCO2
ammonium sulfate (aerosols)	500 g	PMEL
basic blue	20 ml	SIO
BHA(O-benzylhydroxylamine chloride) 5% solution	500ml	HU
butanol	32 L	PMEL
calcium sulfate (drierite)	10 kg	PMEL
14C bicarbonate solution	25 mCi	SIO
charcoal	500 g	PMEL
citric acid	2 kg	PMEL
coulometer solution	8 l	uw pCO2
dichloromethane	4 L	RU
DNPH(2,4-dinitrophenylhydrazine) solution	230 ml	HU
ethanol	8 L	SIO
ethyl acetate	500 ml	HU
formalin	500 ml	SIO
glycerol 30%	500 ml	SIO
gluteraldehyde	40 ml	SIO

hexane	2 L	PMEL
hydrochloric acid	5 L	SIO
hydrochloric acid	500 ml	PMEL
hydrogen peroxide	500 ml	PMEL
isopropyl alcohol	16 L	PMEL
isopropyl alcohol	2 L	uw pCO2
magnesium perchlorate	2 kg	uw pCO2
Malcosorb	2 kg	uw pCO2
methanesulfonic acid	1 L	PMEL
methanol	20 L	SIO
methanol	4 L	PMEL
methanol/methylene chloride 1:1 mixture	4 L	HU
PEA phenothylamine	150 ml	SIO
phosphoric acid	1 L	PMEL
potassium carbonate	2 kg	PMEL
potassium iodide	500 g	uw pCO2
scintillation cocktail	3 gal	SIO
Na2CO3 2% methanol solution	500 ml	HU
Na2CO3	100 g	HU
NaNO2 20% methanol solution	500 ml	HU
sodium hydroxide (50% w/w)	1 L	PMEL
sulfuric acid (0.1 M)	500 ml	PMEL
Tween solution (concentrated)	100 ml	SIO

Appendix D: Protocol for Photosynthesis vs. Irradiance Experiments During ACE-Asia

Isotope Usage (SIO):

- * Our isotope usage and total stock aboard NOAA Ship Ronald H. Brown will not exceed 25 mCi of carbon 14. The maximum usage in one day will be 0.6 mCi. (Each day we will use 1-5 uCi per sample. We will be performing experiments at 4 depths with 25 samples at each depth giving a total of 100 samples per day.)
- * The carbon 14 stock will be transported directly from the manufacturer or from UCSD Environmental Health and Safety to the boat in liquid form. All carbon 14 will be stored within the refrigerator of the Scripps Photobiology Group van.
- * All isotope work will occur only within the isotope section of the Scripps Photobiology Group van. While in the isotope section of the van, personnel will wear lab coats, gloves, and disposable protective footwear. The back 1/3 of the van is considered the isotope section. This section of the van contains the hood and the refrigerator. The floor is sealed and there is a dam on the floor separating the isotope section from the remainder of the van. The isotope section of the van has been checked by Environmental Health and Safety at UCSD and is approved for isotope work.
- * No samples, stocks or waste will be removed from the isotope section of the van until the end of our segment of the cruise in Yokosuka, Japan. All radioactive materials will be packaged in secondary radiation-approved containers before being removed from the isotope section of the van.
- * We will be working under B. Greg Mitchell's UCSD license (RUA 869). Scott Storms is an authorized user on the above-mentioned license.
- * Wipes will be done weekly while aboard. If a scintillation counter becomes available, it will be brought and wipes will be processed immediately. If a scintillation counter is not available, the wipes will be shipped back to Scripps Institution of Oceanography. The wipes will be processed when received at SIO and results of the wipes will be e-mailed to the ship. We estimate this procedure to take approximately 7 days after arrival in port. In addition, we plan to have a hand-held counter on board. This counter should have a 14% efficiency for carbon 14 and would be useful if a spill occurred.

Waste:

The following samples/waste will be transported back to the US from the Yokosuka, Japan after the cruise. All shipping will be coordinated by Sandy O'Brien of UCSD Environmental Health and Safety according to US, International and Japan regulations.

- * Samples - 4000 scintillation vials with a combined activity of less than 0.5 uCi

- * Dry waste - we will have 4-5 bags of dry waste and 5-10 one gallon jugs (e.g. milk gallons) for pipette tips, both with trace amounts of radioactivity
- * Liquid waste - we will have approximately 3L of liquid waste with less than 3 mCi of activity
- * Remaining stock - less than 10 mCi

All waste/samples will be transported in secondary, radiation-approved containers.

Our samples will be acidified and 99.99% of the radioactive carbon will be released from the fume hood while the ship is underway. For example, although 1-5 uCi will be added to our samples, on average only 0.0005 uCi will remain after acidification. The carbon dioxide will be released in accordance with NRC regulations limiting the exposure of the general public to radioactive materials.

Procedure for Dealing with Spills and Personnel Contamination Spills:

- 1) Notify individuals in the area of the spill's occurrence, location, size and nature.
- 2) Wash your hands if they have become contaminated as part of the spill incident.
- 3) Put on personal protective equipment including gloves, lab coat and eye wear to prevent contamination of the hands, body, and street clothes, if these are not already being worn.
- 4) Define and confine the spill zone. Mark off the spill area with chalk, markers, tape, etc. and restrict traffic to that area.
- 5) Individuals in the spill zone must stay within the zone until monitored for contamination, then decontaminated and/or established as free of contamination. Individuals initially within the spill zone should move to the area of lowest exposure.
- 6) If the spill was of dry material, dampen the spill slightly. This will avoid the spill's spread due to air currents or wind. Be careful not to spread the spill area unnecessarily. If the spill was of liquid material, cover the liquid with absorbent material (such as paper towels or Dessicant) to limit the spread of contamination.
- 7) Shut off fans or air circulation devices. Direct exhaust ventilation should be left operating.
- 8) Notify the captain, resident marine technician, operations officer, chief scientist or other designated individual(s).
- 9) Once the spill zone is controlled, then emphasis shifts to decontamination procedures. Begin decontamination procedures as soon as possible. Cleaning agents normally used in the laboratory environment should be adequate. SIO radioisotope isolation vans are equipped with spill kits

containing the necessary materials. In addition, RadCon surface cleaner is very effective in removing radioactivity from difficult to clean surfaces. Start at the periphery of the contaminated area and work inward. Systematically reduce the contaminated area. Avoid using large circular cleaning motions, as this practice will increase the spill's surface area. Mitigation of liquid bicarbonate carbon-14 spills can be enhanced by rinsing the area with acid (e.g. 10% HCL), releasing the C14 as C14O2. This should be done only in a well ventilated area.

10) Put all contaminated, disposable materials into plastic bags for appropriate disposal later. Contaminated laboratory equipment should be bagged or set aside in dishpans for later decontamination.

11) Survey meter and/or wipe tests will be used to monitor the progress of the decontamination.

Personnel Decontamination

- 1) Administer first aid if necessary.
- 2) Be aware of personal and ethnic privacy issues when decontaminating personnel.
- 3) Define the area of contamination. Note the quantity of contamination, size and location.
- 4) Begin decontamination procedures with the mildest form of cleansing. Skin should be decontaminated using mild soap and water. The decontamination should progress to using soap with a mild abrasive, soft brush and water, then to a mild organic acid (citric acid, vinegar). Nails or hair may need to be trimmed to complete the decontamination. Decontamination procedures should not break the skin.
- 5) Survey meter and/or wipe tests will be used to monitor the progress of the decontamination.
- 6) Record the size, location, and degree of contamination. Give this information to the captain, resident marine technician, operations officer, chief scientist or other designated individual(s).
- 7) Put all contaminated, disposable materials into plastic bags for appropriate disposal later.
- 8) Clothing may need to be removed or changed. Contaminated clothing may be bagged and retained for decay or disposal.

Appendix E. Van locations

